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AUTHOR Appleton, Ken
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ABSTRACT

Reflection is a key aspect of the practicum experience for preservice teachers at the University of Central Queensland (Australia). However, ensuring that reflection occurs has been somewhat problematic. A study was conducted to explore how theoretical constructs based on learning theory can be used to guide the function of the practicum and the place of reflection in such a framework. A reflective practicum component was integrated into a curriculum subject, using constructivist learning theory as a guide. Teacher interventions derived from the learning theory provide guidelines for the placement and operation of the practicum and for encouraging reflection about both the practicum and classwork. An evaluation of the subject was carried out using a variety of data. In addition, the report discusses selected findings, the success of the subject in influencing cognitive and affective outcomes, the role of the practicum, and indications of the occurrence of reflection by students. A brief explanation and diagram of the constructivist learning model on which teacher inventions are based is included. Teacher interventions based on both constructivist theories and use in the subject are displayed in tabular form. (LL)

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USING LEARNING THEORY TO GUIDE REFLECTION IN THE PRACTICUM

Ken Appleton
Faculty of Education
Central Queensland University

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Ken Appleton

Abstract

Reflection has been considered a key aspect of the practicum for preservice students. However, ensuring that reflection occurs has been somewhat problematic. In this study, a reflective practicum component was integrated into a curriculum subject, using constructivist learning theory as a guide. The learning theory used is explained, and relationships to teaching are explored. Teacher interventions derived from the learning theory provided guidelines for the placement and operation of the practicum, and for encouraging reflection about both the practicum and classwork. An evaluation of the subject was conducted using a variety of data. Selected findings are discussed and the success of the subject in influencing cognitive and affective outcomes are explored. The role of the practicum and indications of the occurrence of reflection by students are also examined.

Introduction

Reflection associated with the practicum has been a major focus of preservice teacher education for some years now (Martinez, 1989). By and large it has been seen as desirable and an important part of the development of teachers, but what it is and how to achieve it is by no means clear. There have been attempts to theorise reflection in the practicum, as pointed out by Martinez, but it has not been clearly grounded in theoretical constructs such as theories of learning. This paper explores how theoretical constructs based on learning theory can be used to guide the function of the practicum, and the place of reflection in such as framework.

The discussion of the practicum in this paper is within the context of a practicum experience associated with a curriculum subject in the second year of a preservice primary/preschool course at the University of Central Queensland. The subject was designed using constructivist views of learning, so that both the organisation and methodology reflected key aspects of constructivism. The practicum was an integral component of the subject, and its organisation and assessment were heavily oriented towards reflection associated with the practicum component.

The Theoretical Construct -Constructivism

Constructivism[1] takes two broad forms: cognitive constructivism, and social constructivism. The former focuses on the student's internal cognitive processes and cognitive

[1] "Constructivism is a theory that assumes knowledge cannot exist outside the bodies of cognising beings....Knowledge is a construction of reality" (Tobin, 1990, p 30). A concise overview of constructivism is presented by von Glasersfeld (1989).

structure during learning, while the latter emphasises the role of human mediation and social context in the shaping of a student's learning. Both views of constructivism can be seen as important to the learning process. In previous discussions of aspects of constructivist theory, I proposed nine "teacher interventions" (see Table 1) which may be developed into teaching strategies to facilitate learning (Appleton, 1990; 1993). The learning theory from which the interventions were derived is summarised in Figure 1, in the form of a learning model. A brief explanation of the model is provided to help the reader's understanding of the interventions.

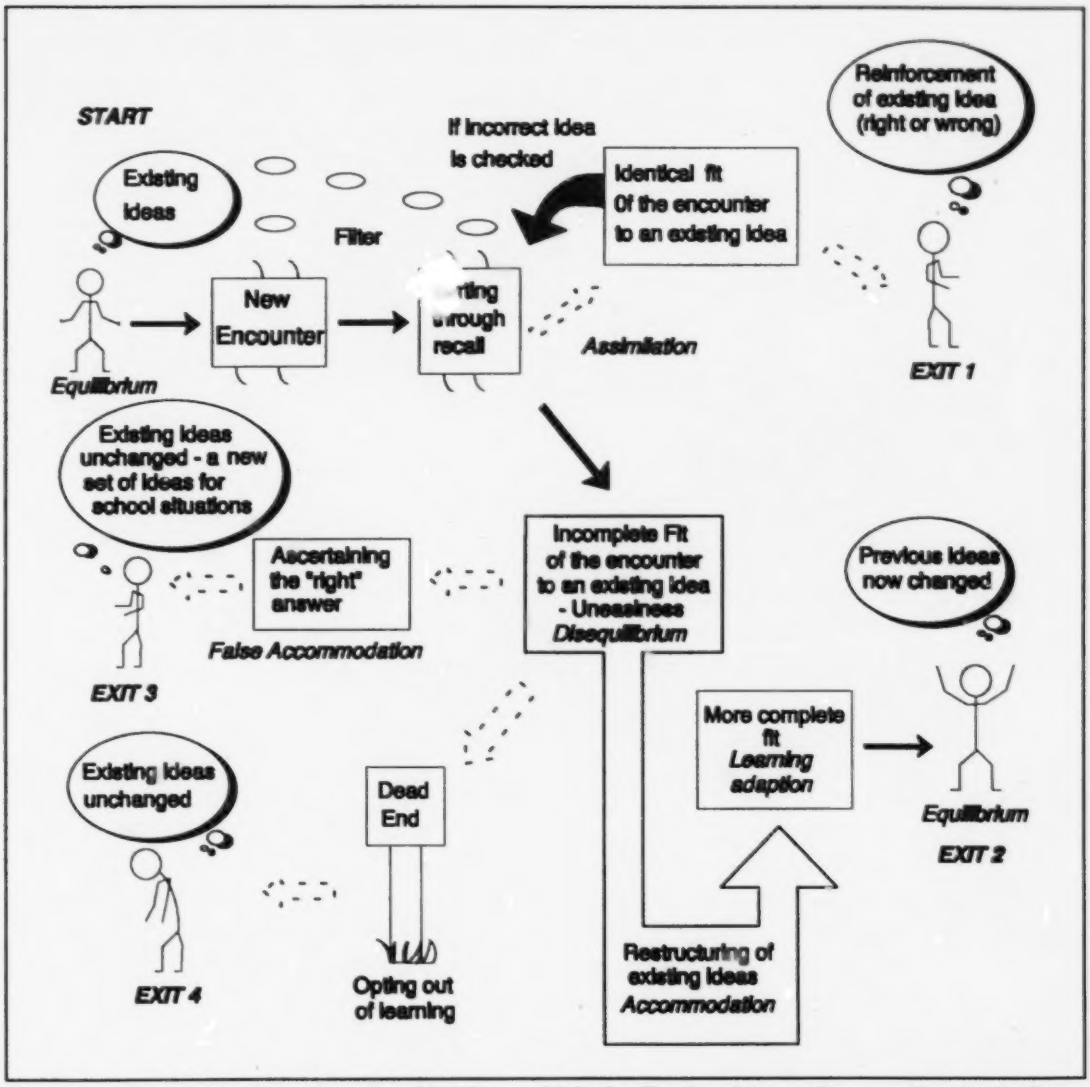

Figure 1 The Constructivist Learning Model on which the Teacher Interventions are based (Appleton, 1990).

An explanation of the model

A learner comes to the learning situation, bringing all previous experiences which are arranged into schemata or minitheories (Claxton, 1990) - a mix of cognition, feelings and

skills. A learning experience commences with some new encounter, which the learner interprets and makes sense of in terms of his or her existing cognitive structure. The classroom context of the learning experience (Claxton, 1990) influences which schemata of the learner's cognitive structure are used to interpret the experience, both in terms of which sensory input to attend to, and which memories are activated in order to construct meaning for the experience (Osborne & Wittrock, 1983). This aspect is represented by the filter in Figure 1. In the process of assimilation (Piaget, 1978/1977), the learner will perceive that either existing schemata provide an adequate explanation for the experience, or there is some inadequacy in that the experience cannot be fully explained.

A learner may perceive that existing schemata provide an adequate explanation for the experience, even if from the teacher's viewpoint, they do not. This may occur if, according to the teacher's intentions, inappropriate schemata are used to interpret the experience, or if some aspects of the experience which do not fit with existing schemata are simply not noticed or even ignored. Many a learner would then leave the learning situation (Exit 1) with existing schemata reinforced (Appleton, 1989): The new learning desired by the teacher is not acquired. Such learners may even be able to use vocabulary appropriately so that, to themselves and their teachers, they appear to understand the experience. However, if the learners are redirected to the experience and made aware of any deficiencies in their schemata, they should then move to a state of disequilibrium (Appleton, 1989).

Disequilibrium (Piaget, 1978/1977), or dissonance (Festinger, 1957), occurs when the learner recognises that existing schemata are inadequate to explain the experience. This results in uneasiness (Piaget, 1978/1977) and a desire to reduce it by resolving the conflict between experience and schemata (Festinger, 1957). Claxton (1990) sees this as a natural process of learning, where various minitheories, as he calls them, are tried against the experience. Such trials are an attempt to find a minitheory best able to make some sense of an experience which does not fit any minitheory exactly. When some fit is achieved, the selected minitheory is modified to incorporate the new experience. This process represents Exit 2 in Figure 1. Here, the learning achieved would be meaningful to the learner, and would usually be considered as the preferred educational outcome. In Festinger's terms, a consequence of dissonance is often information-seeking behaviour. By obtaining further information, dissonance is reduced as the learner modifies existing schemata, extends them, or constructs a new one (Osborne & Wittrock, 1983). A single experience of accommodation (Piaget, 1978/1977) as described would be inadequate for any major changes to a learner's cognitive structure, so the new structure would need to be used and tested in a variety of situations to be useful and accessible (Osborne & Wittrock, 1983). Many learners would need assistance in accessing and interpreting new information relevant to the experience, so that appropriate modifications to schemata, and links between them, could be made.

Many learners have developed alternative cognitive strategies to those of information-seeking and cognitive restructuring which they may apply to learning situations (Claxton, 1990). A common strategy is represented by Exit 3 in figure 1, where the learner waits for "correct" information to be provided - by a book, the teacher, or some other authority - and then rote learns what has been provided. The information is recalled most readily in a context similar to that where it was provided, so may not be accessible in other contexts.

Such "false accommodation" is often used in universities when students prepare for examinations, and is seen by many students and perhaps even a few lecturers as a desirable cognitive strategy.

Some learners may not consider the effort involved in pursuing either of Exits 2 or 3 as worthwhile (Festinger, 1957), and so opt out of the learning experience, as represented by Exit 4. Alternatively, some learners may have experienced repeated failure in science, and to avoid further failure opt out of the learning situation. Specific teacher actions are usually required to reduce the likelihood of learners taking Exits 3 or 4.

The Teacher Interventions

The above constructivist principles were used to develop nine teacher interventions, outlined in Table 1. In the planning for a science and technology education subject, the teacher interventions were used as an organising construct. Constructivist teaching principles were modelled to the students during the classwork in several cognate areas, which were then applied by the students in the practicum. The main cognate areas addressed were gender inclusiveness, teaching approaches useful in science teaching, constructivist learning theory, the nature of science, and misconceptions in science. Table 2 shows how the structure and implementation of the subject was influenced by the teacher interventions, and the place of the practicum component within the interventions.

Pedagogic content knowledge and pedagogic knowledge (Shulman, 1987) may well be addressed in University classwork, but according to constructivist theory, may not be learned in a practical real-life sense (Osborne & Freyberg, 1985). Constructivism would suggest that students need to construct their own pedagogic content knowledge and pedagogic knowledge, building on their classwork by applying their tentative knowledge in real-life situations. The practicum was therefore placed as an application phase in the teacher interventions. The main impetus for reflection was derived from the assessment requirements. The second assignment in particular required students to reflect on both their planning and implementation.

Note that, although the interventions are presented neatly as a linear sequence, they do not occur so neatly in practice. For example, although the practicum has been presented as an application phase, for many students it would also be a new encounter and accommodation phase as they come to grips with the problem of actually teaching a unit to a group of pupils.

Table 1: Teacher Interventions based on Constructivist Theories

Interventions	Description
1. Identify Preconceptions	The teacher identifies the types of preconceptions which students hold. Information can be obtained from the literature or the students themselves.
2. New Encounter	The teacher chooses an encounter which is motivating, allows first-hand exploration, provides a link to past experiences, and leads to an incomplete fit for most students.
3. Ideas Links Are Being Made To	The teacher ascertains which existing ideas students are linking to, and what aspects of the encounter they are focusing on. These can be elicited by encouraging students to talk freely about the encounter.
4. Challenge Incorrect Ideas	Students who link to an inappropriate idea, or inappropriate aspect of the encounter, yet see it as an identical fit, will exit with an incorrect idea reinforced unless the teacher takes action to challenge the idea. This could be done directly, by testing the idea, by seeking other ideas and evaluating them, or by drawing students' attention to key aspects of the encounter.
5. Avoid False Accommodation	Many students who take the false accommodation route wait for somebody to provide an answer for them to learn. The teacher must recognise this and refrain from engaging in games which help the student guess the intended answer. Nor should students be permitted merely to wait for an answer to be provided. This behaviour would be reduced if students are expected to provide their own tentative answers.
6. Prevent Opting Out	The teacher knows the students well enough to recognise when they are losing interest, or when they reach a sufficiently high frustration point to opt out of the learning situation. She or he steps in with encouragement, perhaps a little more structure, or some other form of help.
7. Help Towards Accommodation	Some students reach accommodation without assistance, but many need help. The type of help needed depends on the teacher, student and context, but may include helping students plan activities, providing an explanation of a theory or phenomenon, helping find suitable reference material, providing a forum for discussion of ideas, and interpreting the ideas of others into a more understandable form.
8. Applying New Ideas	The results of accommodation may be short-lived and tentative. To improve the status of newly accommodated ideas, the teacher provides opportunities for students to use them in practical real-life situations. The practice should preferably be in a problem solving form, and the problems should address issues which are real to the students and their world.
9. Diagnosis and Remediation	Students' understanding may still be incomplete, partial, or completely inappropriate. The teacher, if not already having done so, diagnoses ideas students have formed, and decides what further teaching action, if any, would be appropriate. Suitable experiences for closure of the unit of work should also be included.

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Table 2: How the Teacher Interventions were used in the Science & Technology Education Subject

Interventions	Use in the Subject
1. Identify Preconceptions	The lecturer surveyed and interviewed students to identify common preconceptions students had about science and technology teaching.
2. New Encounter	A teaching segment based on toasters, using constructivist principles was modelled for the students, where they were put into the role of learners. The learning/teaching process was examined using the literature to put the events in an overall context.
3. Ideas Links Are Being Made To	During classes, the students' ideas were revealed in discussions with the lecturer and with peers in workshop groups. The lecturer monitored group discussions, and report-back sessions encouraged sharing of ideas. The first assignment was designed to expose students' ideas, so those who did not always actively participate in discussions could be included.
4. Challenge Incorrect Ideas	During workshop and whole group discussions, students often challenged each others' ideas . If not, the lecturer challenged misconceptions in a supportive way. The first assignment was also designed to allow the lecturer and other students to challenge misconceptions.
5. Avoid False Accommodation	The lecturer consistently refused to provide answers which could be reproduced in assignments. Further, the assignments were designed to oblige students to show their own understanding of the topics. However, help in understanding ideas was available at all times.
6. Prevent Opting Out	At a tertiary level, this is difficult to detect, and was not necessarily well catered for. The first assignment allowed the lecturer to identify students in difficulty, seek them out, and provide help for them.
7. Help Towards Accommodation	A variety of helping strategies were employed: videos, lectures, articles and books, peer discussions, explanations and examples provided by the lecturer to groups and individuals.
8. Applying New Ideas	This occurred in the in-school practicum component, where the ideas being acquired by the students could be put into practice with children in a relatively risk-free situation.
9. Diagnosis and Remediation	The lecturer monitored the students' practicum component, using this as a diagnostic tool to identify students still having difficulties. This did not reveal all such students. The second assignment was the final check, and students with small areas of difficulty were able to resubmit work after specific help.

The Practicum Component

As shown in Table 2, the practicum component of the subject was designed as an application phase within a constructivist framework, where students were to apply knowledge they were constructing in the cognate areas introduced in the classwork. The practicum component occurred during class time, and consisted of three visits to a local primary school. Pupils from two classes of the same year level were divided among the students, who had the option of working by themselves or with a partner.

Each student therefore had a small group of two to four pupils, depending on the size of the classes. The first school visit was designed to allow students to apply the diagnostic

techniques they had learnt for identifying any pupil misconceptions, and to explore the nature of any they identified. During the second and third visits the students were to apply all of the subject content by teaching a short science unit drawing on the cognate areas explored in the subject. They planned the unit themselves, and were required to evaluate it as well. The planning and evaluation became components of their second assignment for the subject. Reflection about both the subject content and its application in the practicum was therefore required by the structure of the assignment.

An Evaluation

The subject was evaluated using pre and post questionnaires, interviews with nine students conducted by someone other than a lecturer, and open-ended anonymous comments at the end of semester. Student assignments submitted for assessment were also used to ascertain the extent to which students were reflecting on their practice.

Students' comments

Comments about the school visits from interviews and open-ended written statements were all positive, and highlighted the importance of the school visits to the students' learning and the reflection process. For example:

> *I found (the subject) enjoyable and could relate all content to actual practice either in tutorials or on a school visit.*
>
> *School visits where the theory is put into practice is* ***excellent****.*
>
> *I found the subject very insightful. The practical tutorials and the school visits were the most relevant. The theories provided a good support for experiences and reflection. Excellent relevance to school visits.*
>
> *The subject ... has taught me a lot about putting science into practice in the classroom.*

Assessment

As might be expected, student assignments varied in quality. Evidence of reflection was one of the marking criteria. Overall, the examiner was impressed with the level of reflection about the practicum revealed in students' answers. All students who were successful in the subject showed some evidence of reflection in their assignment work, and many (30% of successful students) showed very high levels of reflection. I have selected at random a few examples of statements by students in their assignments which provide evidence of reflection:

> *I did not act as teacher, but rather as a friend who was helping them to learn. I was very casual about my approach and did not make things seem so routine. This technique worked effectively as the children did not feel threatened to contribute to the lesson in fear of getting things wrong. I*

would not usually take this kind of approach, yet as the group was very easy to manage, I found this suitable at the time.

Planning for the first lesson was not sufficient and thus our lack of initiative led to a less successful lesson where we virtually gave up in our (teaching) approach to that lesson. The unit was adjusted accordingly and with both teachers making a conscious effort, the second lesson ran smoothly. It was discovered, as previously known, that approaching the lesson and the teaching in a positive and confident manner results in a more productive lesson.

Pre and post surveys

The surveys were not used to try to isolate the effect of the practicum, given the extent to which it was integrated with the other subject components. Rather, they focused on the effects of the subject overall on students' confidence levels and ideas about teaching science and technology. A summary of selected components of the surveys shown in Tables 3 and 4 reveals the overall success of the subject in effecting changes in students' attitudes and views about teaching science. Significance levels were established by an analysis of variance test followed by several t-tests. The t-test results are included in the tables. All items were rated on a five-point Likert scale, with one the highest rating.

Table 3: Pretest and Posttest Scores for Survey Items - Confidence in teaching science & technology (N=139)

Item Students' perceptions of their:	Pretest Mean	Posttest Mean
Level of interest in teaching science (high/low)	2.4	2.1[1]
Level of interest in teaching technology	2.7	2.4[2]
As a future teacher I think my teaching of science would be (competent/not so great)	2.5	2.2[1]
As a future teacher I think my teaching of technology would be...	2.9	2.6[2]

[1]Probability less than or equal to 0.001
[2]Probability less than or equal to 0.01
Ratings were on a five point scale, with one the highest rating.

The changes in students' attitudes and ideas about teaching science and technology shown in Tables 3 and 4 were consistent with the thrust of the subject. The subject was therefore highly successful in achieving its aims, and from the students' comments mentioned above, the practicum component was a significant part of the whole learning experience.

Table 4: Pretest and Posttest Scores for Survey Items - Teaching strategies (N=139)

Item Teaching science should involve:	Pretest Mean	Posttest Mean
Teacher-led discussion	2.6	2.9[2]
Teacher demonstrations	2.1	2.8[1]
Teacher explanations	2.0	2.7[1]
Media presentations	2.7	2.8
Guest speakers	3.1	2.9[2]
Children doing teacher-led activities	2.3	2.6[1]
Children doing their own activities	1.9	1.6[1]
Children discussing in small groups	1.8	1.6[1]
Children doing directed written work	3.2	3.4
Children doing their own assignment/ project	2.2	2.1

[1]Probability less than or equal to 0.001
[2]Probability less than or equal to 0.01
Ratings were on a five point scale, with one the highest rating.

Conclusion

The evaluation of this subject has shown the cognitive and affective gains in students from a curriculum subject which includes an integrated reflective practicum component. While these gains cannot be attributed directly to the practicum component, the students identified it as an important aspect of the subject which contributed to their learning.

The practicum served two purposes. Firstly, it was the application phase of a series of teacher interventions based on constructivist views of teaching and learning. In the practicum then, the students applied the new pedagogic content knowledge and pedagogic knowledge which they were beginning to construct from their classwork. Secondly, the practicum served as a new, challenging encounter of a problematic nature which required the students to reconstruct their views of teaching science and technology, and also addressed learning in the affective domain. Because the practicum was a low-risk experience for the students which maximised their chances of success, the knowledge being constructed was given a high status associated with real-life experience (Osborne & Wittrock, 1983). This makes it more likely for the students to draw upon this learning on future occasions, compared to knowledge acquired in a theoretical sense from normal academic work (Osborne & Freyberg, 1985). Naturally, the real test of this would be what the students actually do when they begin teaching classes of their own.

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Author

DR KEN APPLETON, Senior Lecturer, Faculty of Education, Central Queensland University, Rockhampton, QLD, 4702. Specialisations: primary teacher education, teaching strategies in science, cognitive change and learning theories.